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Barry

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(54) **FIREARM SEMIAUTOMATIC TRIGGER MECHANISM**

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See application file for complete search history.

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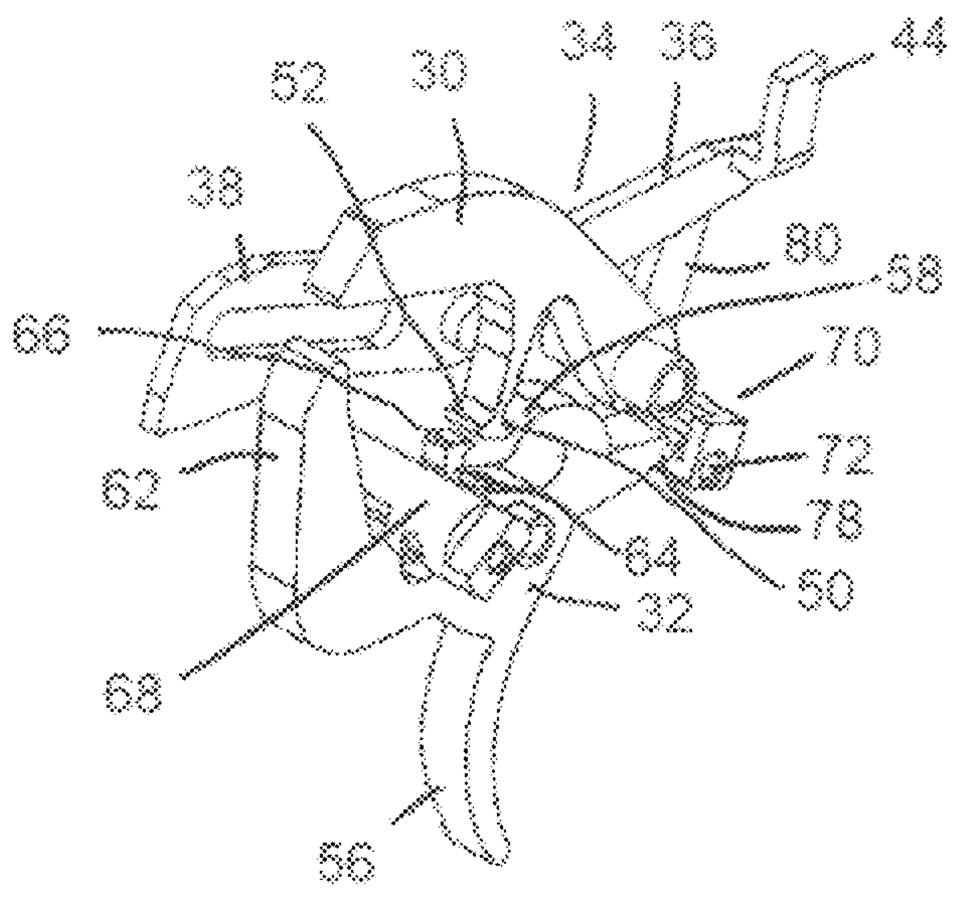
(57) **ABSTRACT**

A trigger mechanism having a hammer, a trigger member, disconnector, movable ejector lever, locking member, and safety the trigger member. The trigger member being forced to the set position by the hammer during rearward pivoting. A locking member is adapted to move between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position. The locking member is spring biased toward the first position and moved against the spring bias to the second position by contact from the movable ejector lever during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position. The safety selector is adapted to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions.

5 Claims, 8 Drawing Sheets



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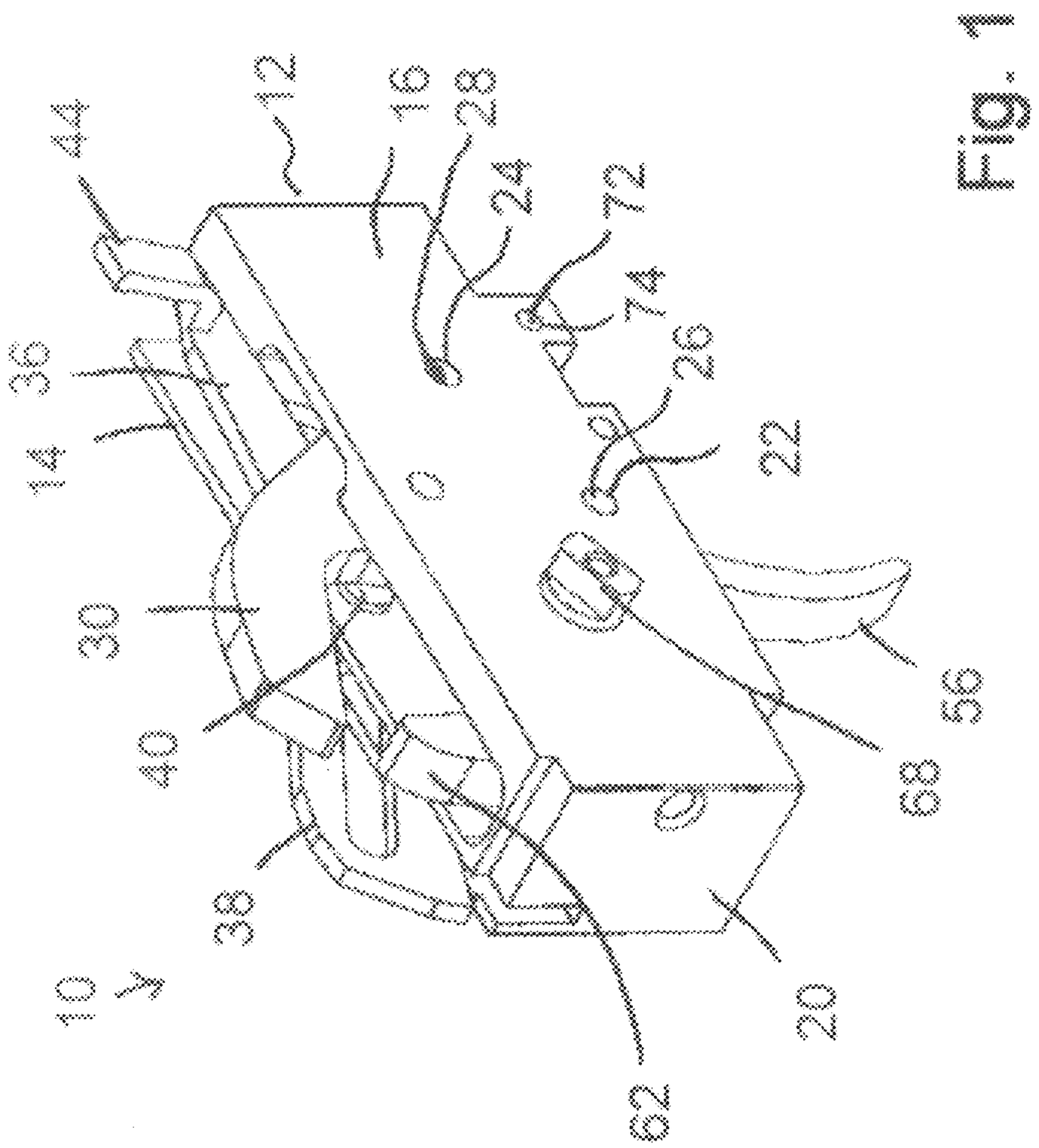

Fig. 1

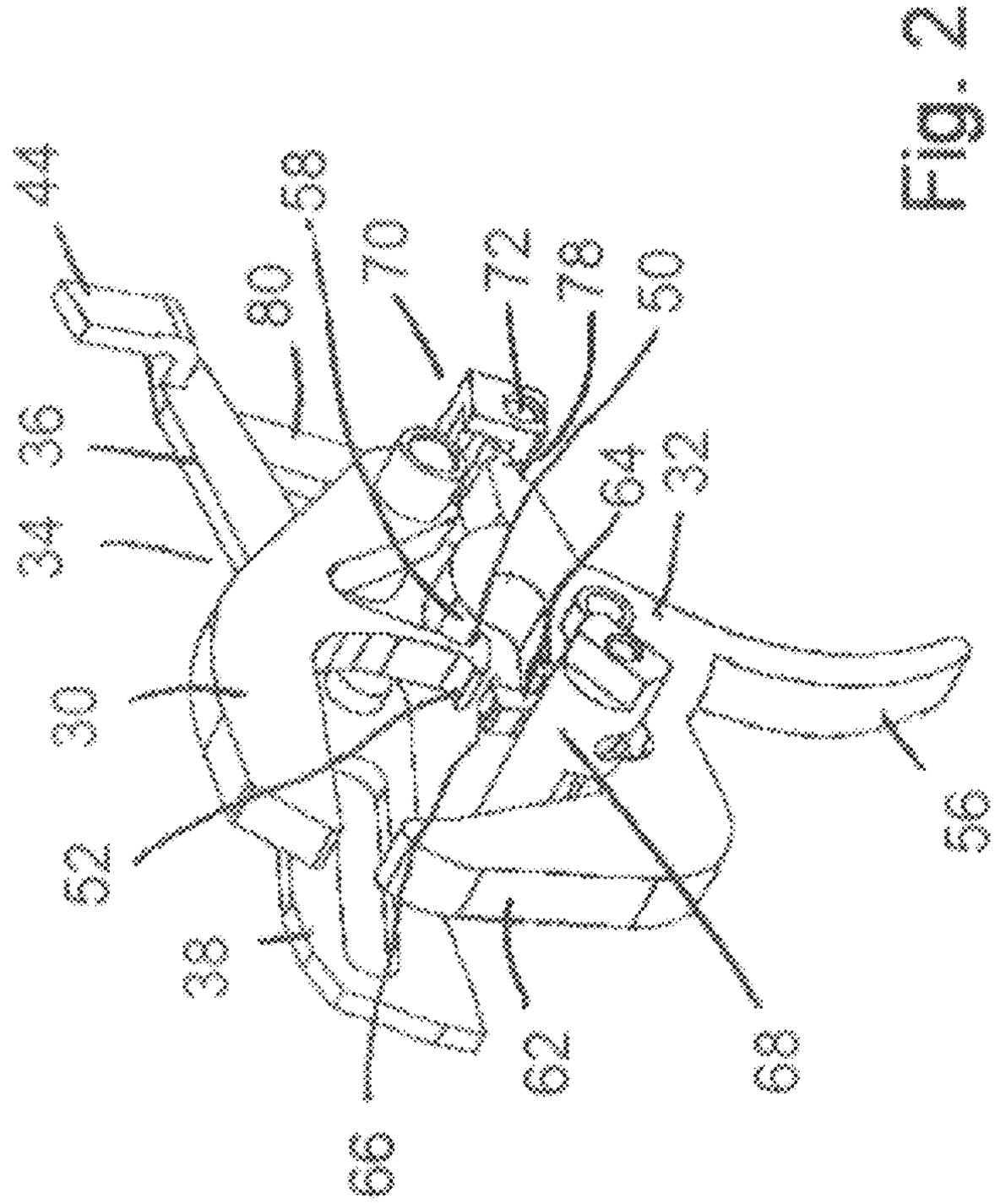

Fig. 2

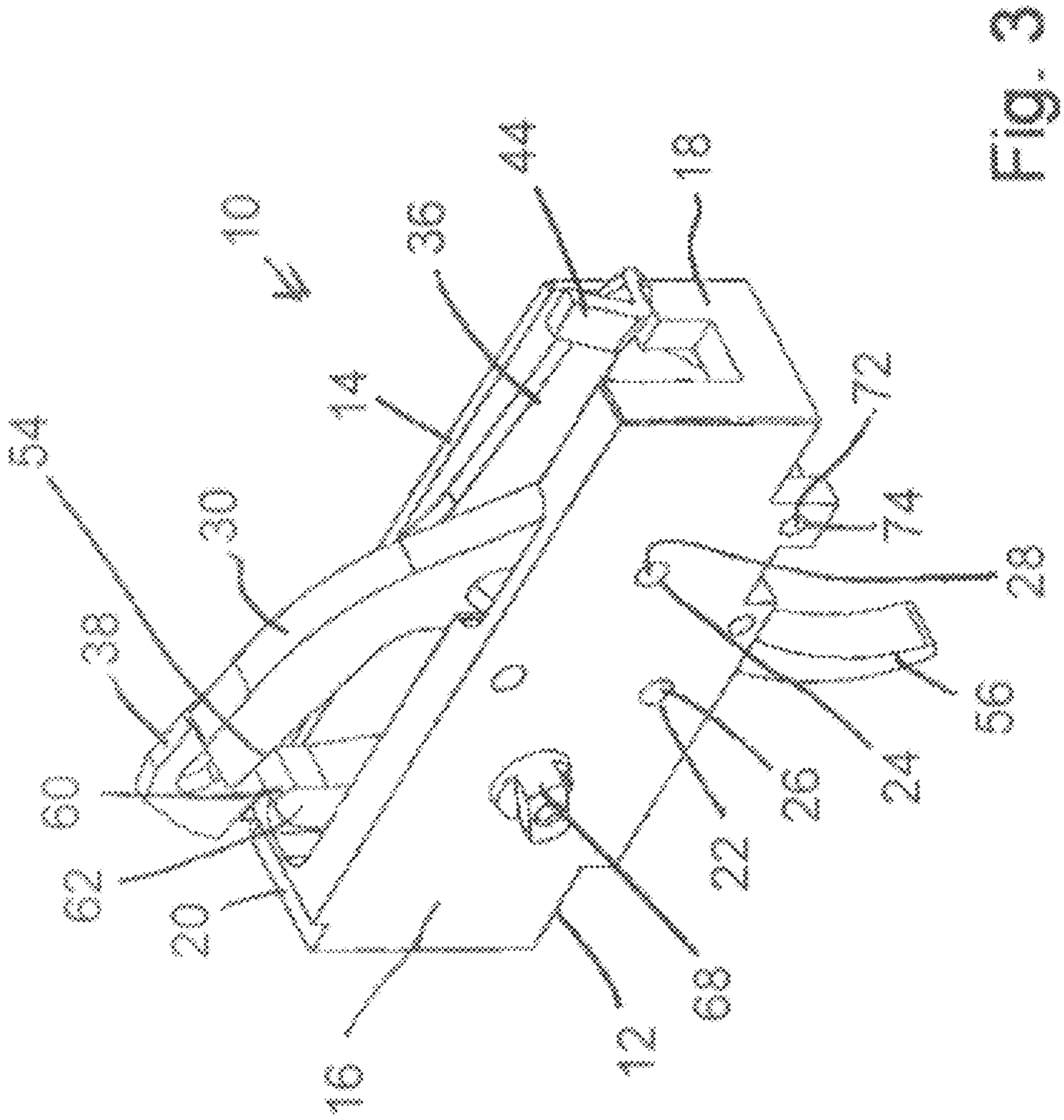
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FIG. 3

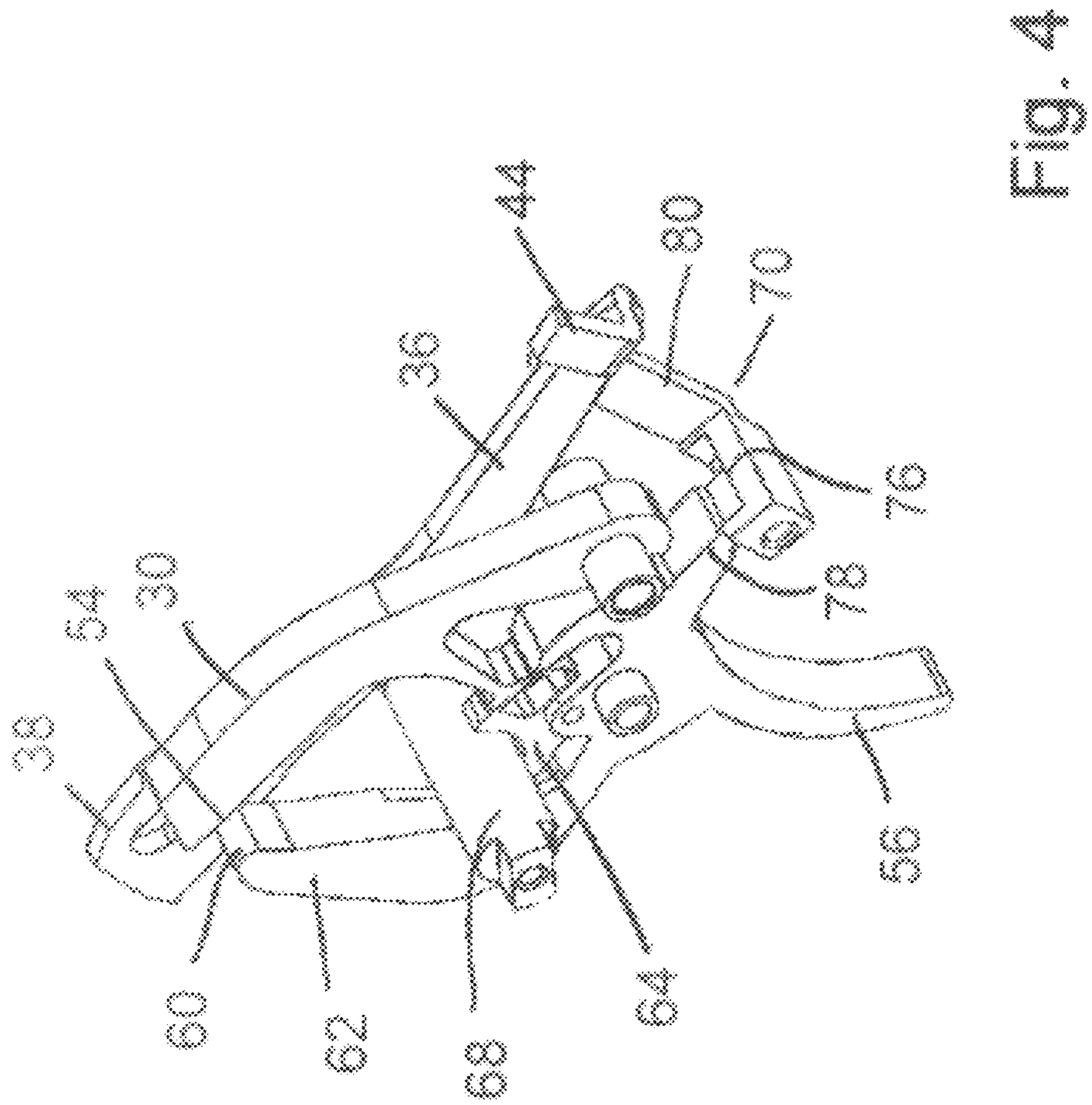

FIG. 5

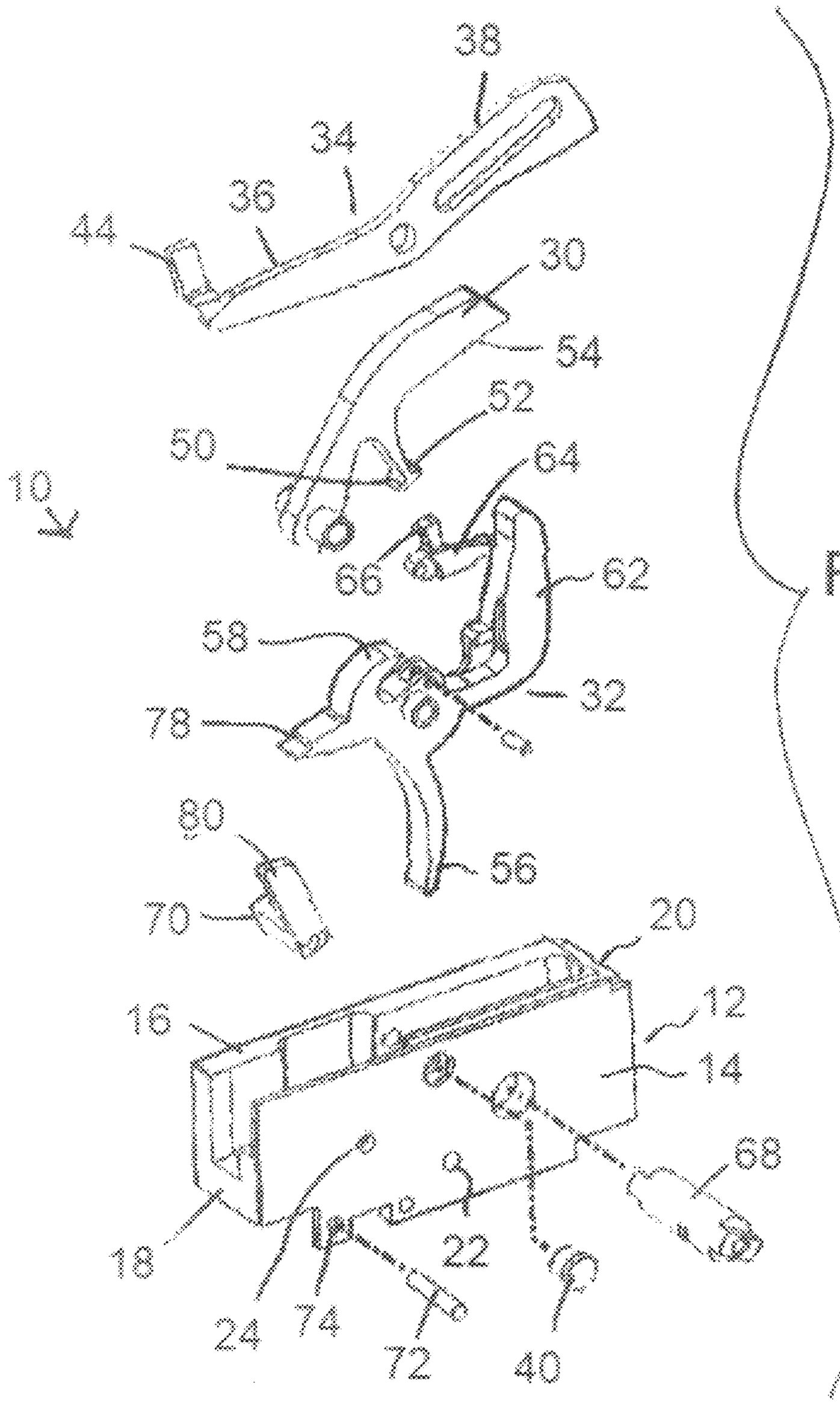
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Fig. 5

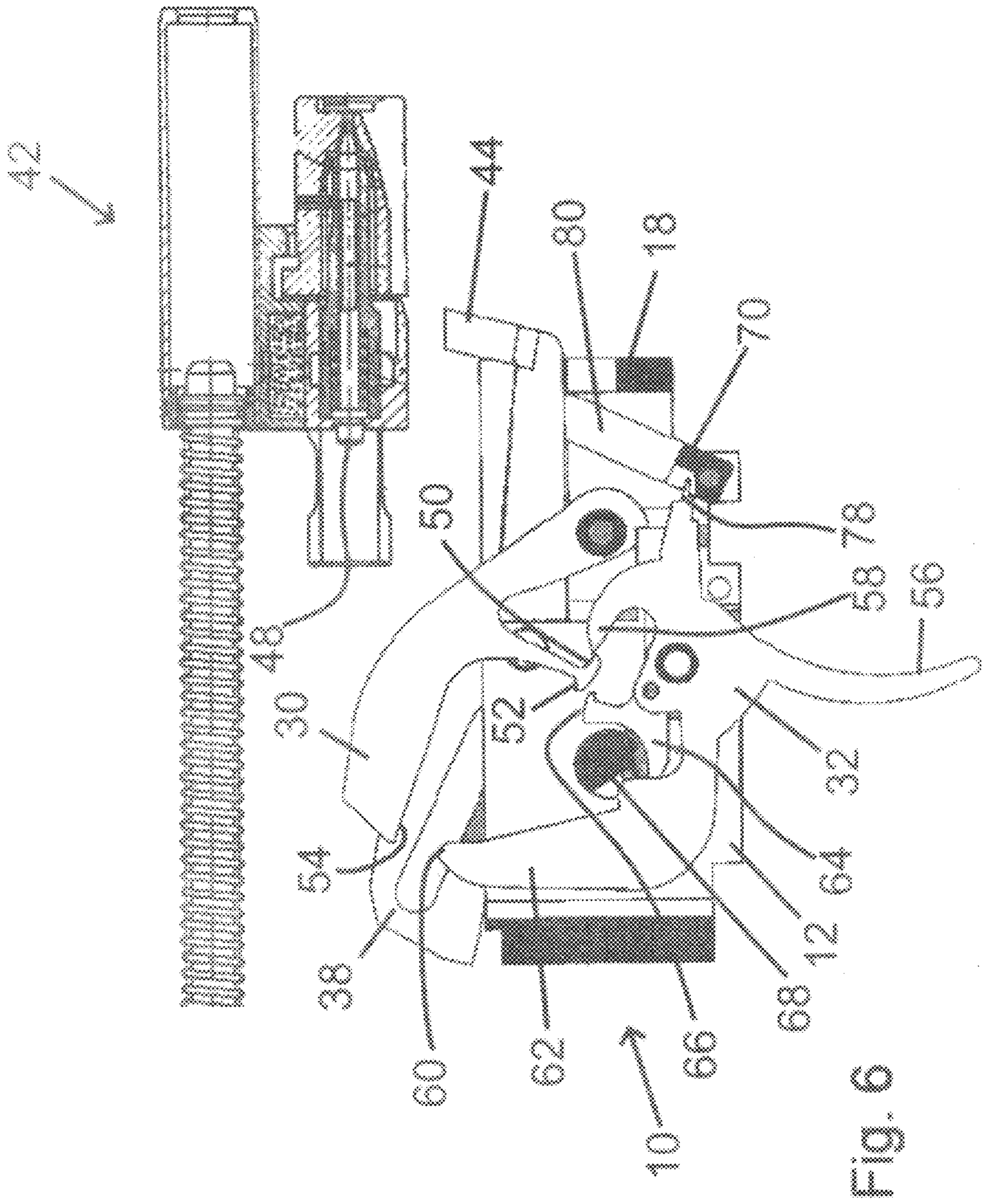

Fig. 6

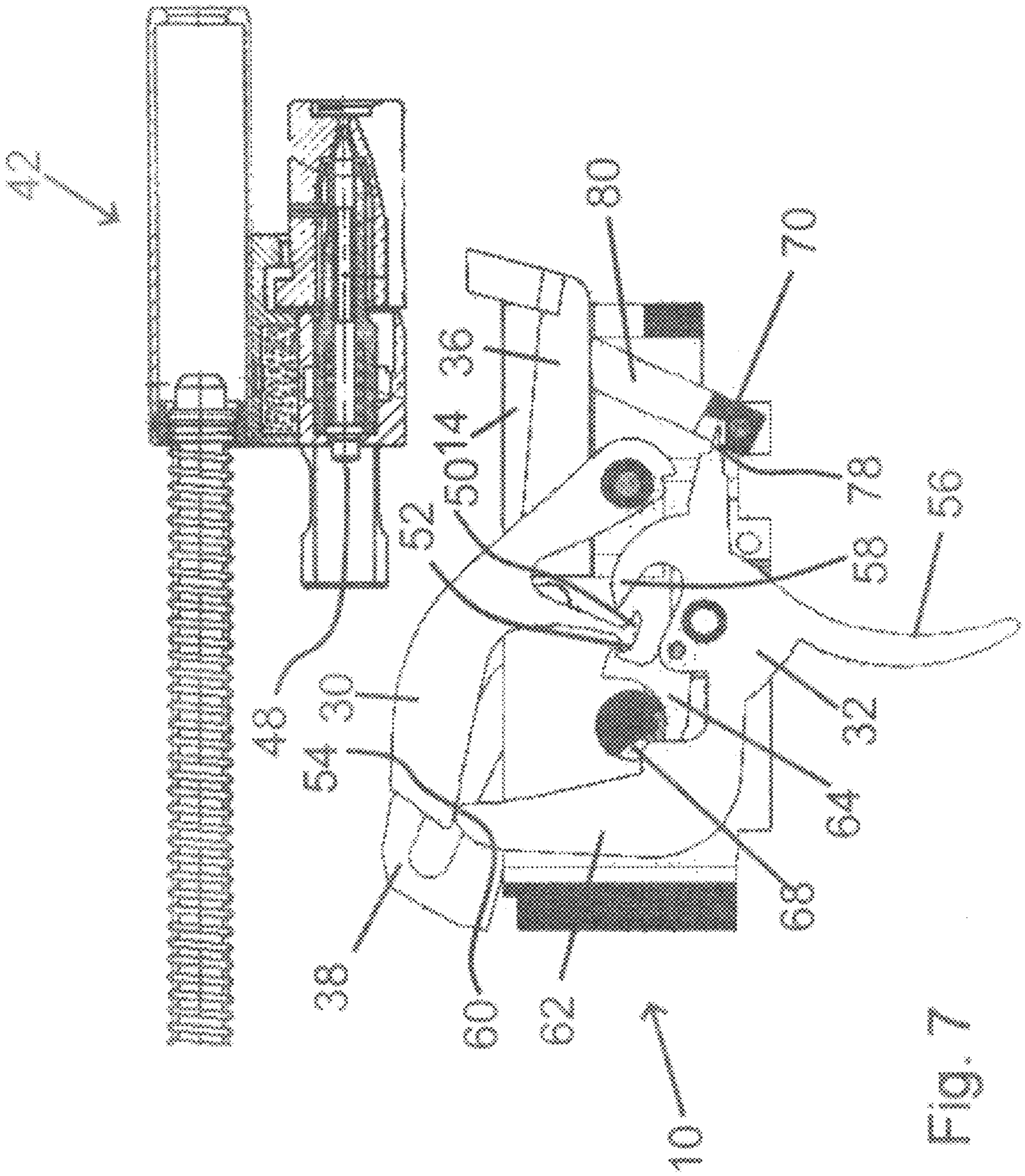

Fig. 7

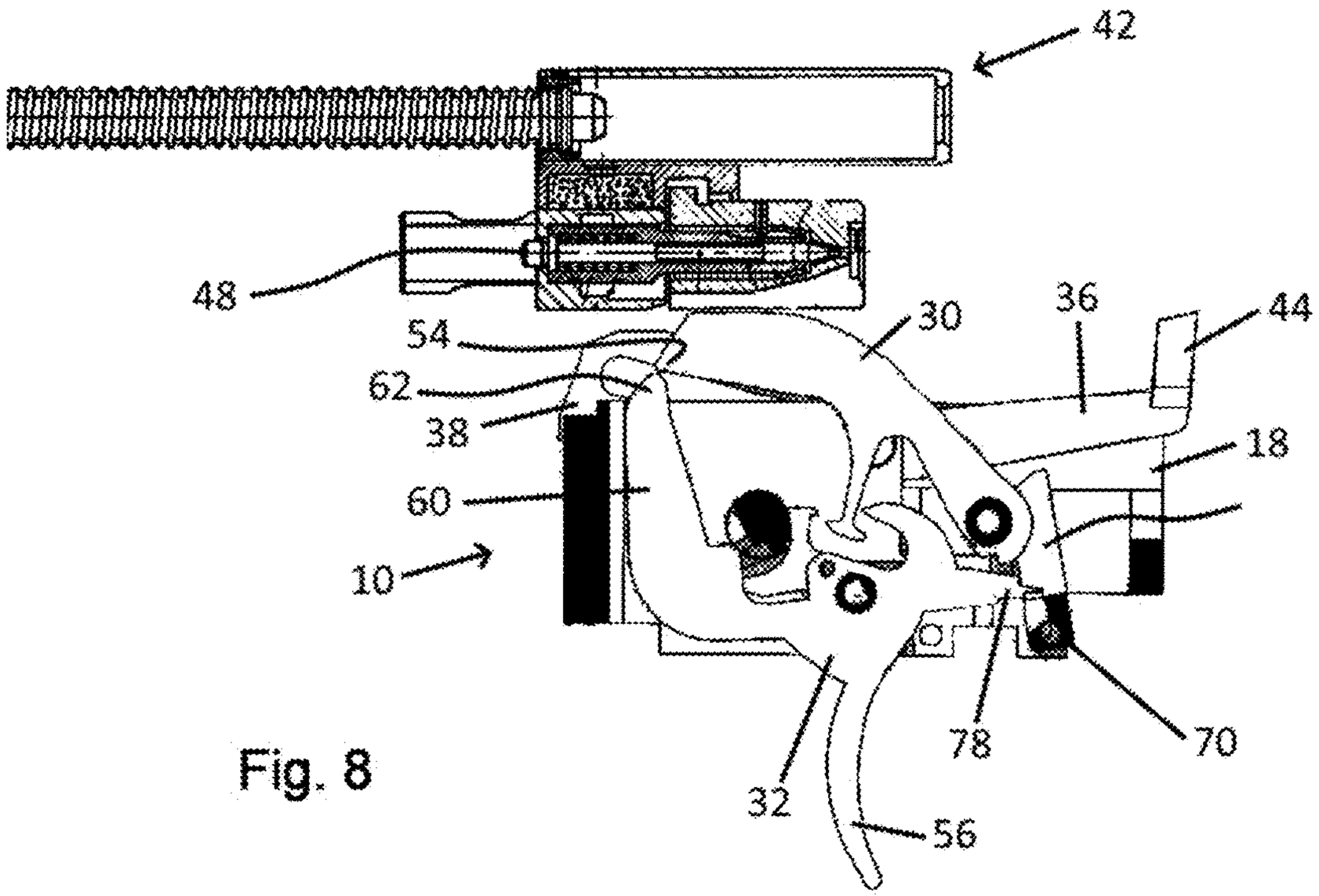

Fig. 8

FIREARM SEMIAUTOMATIC TRIGGER MECHANISM

RELATED APPLICATIONS

This application is a Nonprovisional Patent Application which claims the benefit of priority to U.S. Provisional Patent Application No. 63/523,934, filed on Jun. 29, 2024, the disclosure of which is incorporated by reference herein.

TECHNICAL FIELD

The present invention relates generally to a firearm trigger mechanism, and more particularly to a semiautomatic trigger that can be selectively mechanically reset by the cycling of the action.

BACKGROUND

In a semiautomatic firearm, functioning of the trigger releases a sear, allowing a hammer or striker to fire a chambered ammunition cartridge. Part of the ammunition's propellant force is used to cycle the action, extracting and ejecting a spent cartridge, and replacing it with a loaded cartridge. The cycle typically includes longitudinal reciprocation of a bolt and/or carrier, which also resets the hammer or striker.

A common semiautomatic trigger mechanism includes a disconnector, which holds the hammer or striker in a cocked position until the trigger member is reset to engage the sear. This is one way to allow the firearm to be fired only a single time when the trigger is pulled and held, because the user is not typically able to release the trigger rapidly enough so that the sear engages before the bolt or bolt carrier returns to its in-battery position. The disconnector prevents the firearm from either firing multiple rounds on a single pull of the trigger, or from allowing the hammer or striker to simply "follow" the bolt as it returns to battery without firing a second round, but leaving the hammer or striker uncocked.

For various reasons, shooters desire to increase the rate of semiautomatic fire. Sometimes this is simply for entertainment and the feeling of shooting as rapidly as a machine gun. In the past, users have been known to employ "bump firing" to achieve rapid semiautomatic fire. Bump firing uses the recoil of the semiautomatic firearm to fire shots in rapid succession. The process involves bracing the rifle with the non-trigger hand, loosening the grip of the trigger hand (but leaving the trigger finger in its normal position in front of the trigger), and pushing the rifle forward in order to apply pressure from the finger to function the trigger while keeping the trigger finger stationary. When fired with the trigger finger held stationary, the firearm will recoil to the rear and allow the trigger to reset as it normally does. When the non-trigger hand pulls the firearm away from the body and back forward toward the original position, it causes the trigger to be pressed against the stationary finger to function again, firing another round as the trigger is pushed back. Devices known as "bump stocks" make bump-firing easier.

Another device for increasing the rate of fire in a different way is shown in U.S. Pat. No. 7,398,723, issued to Brian A. Blakley, and is hereby incorporated by reference herein as if fully set forth in its entirety. This device provides a replacement trigger mechanism in which a rotating cam, contacted by the cycling bolt carrier, forces the trigger member to reset between shots. Other forced reset firearms are shown in U.S. Pat. Nos. 9,568,264; 9,816,772; and U.S. Pat. No. 9,939,221, issued to Thomas Allen Graves. The devices shown in these latter patents forcefully reset the trigger with rigid mechanical contact between the bolt and the trigger member as the action cycles. To adapt this invention to other firearm patterns would require not only a modified fire control mechanism, but also a modified bolt carrier.

Other devices for increasing the rate of semiautomatic fire are shown in U.S. Pat. Nos. 10,514,223, 11,346,627, and 11,724,003, which are hereby incorporated by reference herein as if fully set forth in their entirety. In these devices the hammer forces the trigger to the set position, and a locking member, operated by a spring and contact with the bolt or bolt carrier, prevents early hammer release.

Another device for increasing the rate of semiautomatic fire employing a pivoting cam arrangement is shown in U.S. Provisional Patent Application No. 63/374,941 filed Sep. 8, 2022, now U.S. Pat. No. 12,038,247, issued Jul. 16, 2024 also invented by Brian A. Blakley, and which is hereby incorporated by reference herein as if fully set forth in its entirety. This pivoting cam arrangement incorporates a three-position safety selector and associated structure to provide safe, standard disconnector semi-automatic, and forced reset semi-automatic modes.

There are many popular firearm platforms other than the AR-pattern to which the previously known configurations of forced reset triggers may not be readily adaptable. For example, semi-automatic versions the Heckler & Koch MP5 platform and many variations thereof provide a popular pistol caliber firearm, usually with a roller delayed bolt assembly. While the trigger can be adapted to be forced by the hammer to a reset position, it is difficult to adapt a locking member to be actuated (to unlock the trigger member) by the bolt assembly upon returning to a substantially in-battery position.

Further improvement in forced reset triggers, especially for adaptation to other firearm platforms, is desired.

SUMMARY OF INVENTION

The present invention provides a semiautomatic trigger mechanism for increasing rate of fire that can be retrofitted into other popular existing firearm platforms. In particular, this invention provides a trigger mechanism that can be used in MP5-pattern firearms with an otherwise standard bolt carrier assembly. The present invention is particularly adaptable for construction as a "drop-in" replacement trigger module and safety selector. Advantageously, the present invention provides a "three position" trigger mechanism having safe, standard (disconnector) semi-automatic, and forced reset semi-automatic positions. Actuation of the locking member, rather than by contact with the bolt carrier, is by operation of the pivoting ejector.

In one aspect, a firearm trigger mechanism comprises a hammer having a sear catch and a hook for engaging a disconnector and adapted to be mounted in a trigger housing or frame and then fire control mechanism pocket of a trigger grip housing. A hammer pivots on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, the trigger member having a surface positioned to be contacted by the hammer during rearward pivoting of the hammer to cause the trigger member to be forced to the set position. The sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions

of the hammer and trigger member. A disconnector has a hook for engaging the hammer and is adapted to be movably mounted on the trigger member. A locking member is adapted to be mounted in the fire control mechanism housing to move (for example, pivot on a transverse locking member pivot axis or slide) between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position, the locking member is spring biased toward the first position and adapted to be moved against the spring bias to the second position by contact from a movable ejector lever during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position. A safety selector is adapted to pivot between safe, standard semi-automatic, and forced reset semi-automatic modes (positions).

In the standard semi-automatic mode, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the disconnector hook catches the hammer hook, at which time a user must manually reduce pressure on the trigger member so that the trigger spring moves the trigger member to free the hammer from the disconnector, permitting the trigger member to pivot to the set position so that the sear engages the hammer sear notch. Thereafter, the user can pull the trigger member functioning it to fire the firearm again.

In the forced reset semi-automatic mode, rearward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position. The safety selector prevents the disconnector hook from catching the hammer hook. Instead, the trigger is forced to the reset position where its sear catches the sear notch of the hammer. Original to the MP5-pattern trigger mechanism is an ejector that has the form of a crank arm with a central pivot. Rearward movement of the bolt carrier contacts a rearward arm of the ejector, causing a forward arm to be lifted into the path of the cartridge casing (not shown) being extracted from the chamber. The locking member is spring biased toward a first position in which it locks and prevents movement of the trigger member away from its set position. As the bolt carrier reciprocates to the rear and the forward arm of the ejector is lifted, the locking member is spring biased toward this first position. As the bolt carrier returns forward, the forward arm of the ejector is depressed, which in turn moves the locking member to a second position in which it does not block the trigger member from being functioned by an external force (user's trigger finger) away from the set position. When the bolt carrier reaches the substantially in-battery position, the user can pull the trigger member again to fire a subsequent round.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset semi-automatic position, displaces the disconnector preventing the disconnector hook from catching the hammer hook. The trigger mechanism can further include a spring which biases the trigger member toward the set position.

Other aspects, features, benefits, and advantages of the present invention will become apparent to a person of skill in the art from the detailed description of various embodiments with reference to the accompanying drawing figures, all of which comprise part of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Like reference numerals are used to indicate like parts throughout the various drawing figures, wherein:

FIG. **1** is a top rear right isometric view of a drop-in trigger module for a MP5-pattern firearm according to one embodiment of the invention;

FIG. **2** is a similar view with the trigger housing removed for clarity;

FIG. **3** is a top right front isometric view thereof;

FIG. **4** is similar view with the trigger housing removed for clarity;

FIG. **5** is top left front exploded isometric view thereof;

FIG. **6** is a right view thereof with a bolt carrier assembly forward with the hammer and trigger member in their set positions;

FIG. **7** is a similar view showing the hammer caught by the disconnector; and

FIG. **8** is a similar view with the bolt carrier cycled to the rear, resetting the hammer.

DETAILED DESCRIPTION

With reference to the drawing figures, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to "one embodiment," "an embodiment," or "some embodiments" means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus, appearances of the phrases "in one embodiment," "in an embodiment," or "in some embodiments" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments. "Forward" will indicate the direction of the muzzle and the direction in which projectiles are fired, while "rearward" will indicate the opposite direction. "Lateral" or "transverse" indicates a side-to-side direction generally perpendicular to the axis of the barrel. Although firearms may be used in any orientation, "left" and "right" will generally indicate the respective sides or directions according to the user's orientation, "top" or "up" will be the upward direction when the firearm is gripped in the ordinary manner. As used herein, the "substantially in-battery" position of the bolt carrier or bolt refers to being almost fully in-battery when the ejector lever first makes contact with the locking member and begins to move the locking member out of the locked position. The locking member is fully moved to the unlocked position by the point or time at which continued final movement of the bolt carrier or bolt causes it to reach the fully in-battery position.

This detailed description assumes the person of ordinary skill in the art is familiar with the construction and operation of the standard (OEM) semi-automatic fire control mechanism (trigger pack) of an MP5-pattern firearm. As used herein, "MP5-pattern" firearm includes variants thereof of any caliber, whether in a rifle or pistol configuration. While select fire (fully automatic capable) versions of this platform are also MP5-pattern firearms, this invention only relates to semiautomatic firearm actions.

Referring first to FIGS. **1-5**, there is illustrated a trigger mechanism module **10** adapted for use in an MP5-pattern firearm according to a first embodiment of the present invention. The module **10** includes a trigger housing **12**

sized and shaped to fit within the internal fire control pocket of a grip housing (not shown) in place of a trigger pack module/housing for a common (OEM) MP5 semiautomatic trigger group. Some fire control mechanism parts (such as some springs) not important to the disclosure or operation of present invention are well-known in the art and are omitted from the drawing figures for clarity. The housing **12** includes left and right sidewalls **14**, **16** which extend substantially vertically and parallel to one another in a laterally spaced-apart relationship. The sidewalls **14**, **16** are interconnected by transverse forward and rear end walls **18**, **20**. The sidewalls **14**, **16** include at least first and second pairs of aligned openings **22**, **24** for receiving transverse pins **36**, **28** upon which a hammer **30** and trigger member **32** pivot.

Original to the MP5-pattern trigger mechanism is an ejector **34** that is situated laterally offset in the left side of the housing **12**. The ejector **34** has the form of a crank arm with a central pivot between forward and rearward extending arms **36**, **38**. The ejector **34** pivots on a pin **40** carried by at least one sidewall **14** of the housing **12**. The rearward arm **38** is spring biased (spring not shown) upward as in the OEM pattern trigger assembly, which moves the forward arm **36** down. Rearward movement of the bolt carrier **42** (illustrated in FIG. **8**) contacts the rearward arm **38** of the ejector **34**, pushing it downward against the spring and causing the forward arm **36** to be lifted. Upward movement of the forward arm **36** moves an extension finger **44** into a longitudinal slot in the bolt carrier **42** and into the path of the cartridge casing (not shown) being extracted from the chamber, causing the casing to be ejected laterally to the right. Forward return movement of the bolt carrier **42** (FIGS. **6** and **7**) pushes the forward arm **36** of the ejector **34** downward.

The hammer **30** has a hammer head portion **46** that strikes a firing pin **48** when released, a sear catch **50**, a hammer disconnector catch **52**, and a contact surface **54**. The hammer **30** is spring biased (not shown) toward a forward position by a coiled tension spring, similar in design and function to the hammer spring of an AR-pattern fire control mechanism. As shown, the sear catch **50** and disconnector catch **52** may be on opposite sides of a projection from the rear edge of the hammer **30**, the operation of which will be described later.

The trigger member **32** has a trigger blade **56** that extends downwardly. The trigger blade **56** is the part of the trigger member **32** contacted by a user's finger to actuate functioning of the trigger mechanism by user input. The trigger member **32** has a sear **58** which, in the illustrated embodiment, is positioned above the pivot axis of the trigger member **32**. When the trigger sear **58** and the sear catch **50** of the hammer **30** are engaged, the hammer **30** and trigger member **32** are in their set positions holding the hammer against the force of the hammer spring (illustrated in FIG. **6**). When the trigger member **32** is functioned by the user pulling the trigger blade **56** toward the rear, the sear **58** releases the hammer t**30** o be propelled into the firing pin **48** by the hammer spring. A trigger spring (not shown) biases the trigger member **32** toward a ready-to-fire or set position in which the blade **56** is in a forward position.

The trigger member **32** and hammer **30** have contact surfaces **54**, **60** that interact with each other as the action cycles. In the illustrated embodiment, the trigger member **32** includes an upward extension **62** at the rear that provides the contact surface **60**. Just as in the standard MP5-patter trigger assembly, when the bolt carrier **42** cycles to the rear, the hammer **30** is pivoted to (or beyond) the set position in which the sear catch **50** will be caught by the sear **58** of the trigger member **32**. The hammer and trigger member contact surfaces **54**, **60** make contact so that the resetting movement of the hammer **30**forces the trigger member **32** to the reset position.

A disconnector **64** is pivotally mounted on the trigger member **32** and has a disconnector hook **66** configured to catch the disconnector catch **52** on the hammer **30**. The disconnector **64** is spring biased by a spring (not shown) toward a position in which it will engage the disconnector catch **52** of the hammer **30** and can be moved against the spring force to a position in which it does not engage the disconnector catch **52** of the hammer **30**. This allows selective use or operation of the disconnector **64**, depending on the mode in which the trigger module **10** is being operated (controlled by the safety selector switch **68**), as will be described in greater detail below.

A blocking or locking member **70** is movably mounted to the housing **12**. For example, the locking member can be pivoted on a locking member pivot pin **72** that is installed in aligned openings **74** in the sidewalls **14**, **16** of the housing **12**. The locking member **70** is movable (pivotable, in the illustrated embodiment) between first and second positions. The locking member **70** is spring-biased (not shown) toward the first position (FIG. **8**), in which a contact surface **76** engages a forwardly extending tongue **78** of the trigger member **32** to block the trigger member **32** from being moved from the set/ready-to-fire position (in which the trigger sear **58** engages the hammer sear catch **50**). In this first position, the trigger member **32** cannot be functioned by the user applying rearward force to the trigger blade **56**.

The locking member **70** has an arm **80** that is configured to engage with and be displaced by contact with downward movement of the forward arm **36** of the ejector **34**. When the forward arm **36** of the ejector **34** is pushed downward by spring force upon the forward cycling of the bolt carrier **42**, the forward arm **36** contacts and displaces the locking member arm **80** to move the locking member **70** against the force of the locking member spring to a second position (FIGS. **6** and **7**), in which it allows the trigger member **32** to be functioned by the user applying rearward force to the trigger blade **56**. The trigger member **32** is unlocked as the bolt carrier **42** reaches its substantially in-battery position, after which, the trigger member **32** can again be functioned by force of the user's finger to fire a subsequent round.

A three-position safety selector **68** has safe, standard semi-automatic, and forced reset semi-automatic positions corresponding to these modes of operation. When in the safe position, a portion of the safety selector **68** mechanically blocks movement of the trigger member **32** to prevents the trigger blade **56** from being pulled (FIG. **6**).

When in the standard semi-automatic position, the blocking portion of the safety selector **68** is rotated away, permitting the trigger member **32** to be functioned by the user pulling the blade **56** rearward. The disconnector **64** is carried by the trigger member **32** and moves when the trigger member **32** is rotated. The disconnector hook **66** can catch the hammer disconnector catch **52** during rearward pivoting travel of the hammer **30** (FIG. **7**). In this mode, the hammer and trigger contact surfaces **54**, **60** engage/contact and the trigger member **32** is forced toward the reset position. The hammer **30** is caught by the disconnector **64** and held until the user further reduces force on the trigger blade **56** so that the trigger spring further moves the trigger member **32** to cause the disconnector **64** to release the hammer **30**. Once released by the disconnector **64**, the sear catch **50** on the hammer **30** is caught by the sear **58** on the trigger member **32**. The trigger member **32** may then be caused to function again by the user to fire a subsequent round.

When in the forced reset semi-automatic mode (safety selector is in the third or forced rest position), the selector **68** permits the trigger member **32** to be functioned (trigger blade **56** to be pulled) but holds the disconnector **64** displaced against the disconnector spring, preventing the disconnector hook **66** from catching the hammer disconnector catch **52** during rearward pivoting travel of the hammer **30**. Thus, in the forced reset semi-automatic position, the disconnector **64** is "disabled" in that the disconnector hook **66** is unable to catch the hammer disconnector catch **52** during cycling of the action and resetting of the trigger member **32**. Instead, when the hammer **30** is displaced by rearward travel of the bolt carrier **42** and contact by the hammer **30** against the contact surface **60** of the trigger member **32** causes the trigger member **32** to be forced to the reset position, the hammer sear catch **50** is caught by the trigger sear **58**. The locking member **70** prevents the trigger member **32** from being functioned again until the bolt carrier **42** is substantially in battery. The locking member **70** is displaced to its second position against its spring by contact of the arm **80** with the forward ejector arm **36** returning to its downward position. Once the locking member**70** is displaced to the second position, the trigger member **32** is unlocked so that it can again be functioned by external force (the user pulling the trigger blade backward) to fire a subsequent round.

Thus, as the bolt carrier assembly **42** returns forward, the trigger member **32** is held in its set position by the locking member **70**. The trigger member **32** cannot be pulled to release the sear/sear catch **50**, **58** engagement, thus precluding early hammer release or "hammer follow" against the bolt carrier assembly **42** and firing pin **48** as the bolt carrier assembly **42** is returning to battery. When the bolt carrier assembly **42** has reached (or nearly reached) its closed, in-battery position, the forward arm **36** of the ejector **34** contacts and displaces the upward arm **80** of the locking member **70**, disengaging the contact surface **76** of the locking member **70** from the tongue **78** of the trigger member **32**, allowing the trigger member to be function by the blade **56** being pulled by the user. Again, this prevents early hammer release and contact of the hammer **30** against the firing pin **48** before the bolt carrier **42** is completely locked and in-battery.

While various embodiments of the present invention have been described in detail, it should be apparent that modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. Therefore, the foregoing is intended only to be illustrative of the principles of the invention. The invention resides in each individual feature described herein, alone, and in any and all combinations and subcombinations of any and all of those features. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation shown and described. Accordingly, all suitable modifications and equivalents may be included and considered to fall within the scope of the invention, defined by the following claim or claims.

What is claimed is:

1. A firearm trigger mechanism, comprising

a hammer having a sear catch and a disconnector-engaging catch, the hammer pivoting on a transverse hammer pivot axis between set and released positions, and the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier;

a trigger member having a sear and pivoting on a transverse trigger member pivot axis between set and released positions, the trigger member having a surface positioned to be contacted by the hammer during rearward pivoting of the hammer to cause the trigger member to be forced to the set position, such that the trigger member sear and hammer sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member;

a disconnector having a hook for engaging the disconnector-engaging catch of the hammer and adapted to be movably mounted on the trigger member;

an ejector having the form of a crank arm with rearward and forward arms and a pivot axis, rearward movement of the bolt carrier contacting the rearward arm, causing the forward arm to be lifted into the path of a cartridge casing being extracted from a barrel chamber;

a locking member adapted to move between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position, the locking member being spring biased toward the first position and adapted to be moved against the spring bias to the second position by contact from the ejector lever during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position;

a safety selector adapted to move between three positions defining safe, standard semi-automatic, and forced reset semi-automatic modes;

wherein, in the standard semi-automatic mode, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the disconnector hook catches the hammer hook, at which time a user must manually reduce pressure on the trigger member so that the trigger spring moves the trigger member to free the hammer from the disconnector, permitting the trigger member to pivot to the set position so that the sear engages the hammer sear notch, and thereafter, the user can pull the trigger member functioning it to fire the firearm again;

wherein in the forced reset semi-automatic mode, rearward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position and prevents the disconnector hook from catching the disconnector-engaging catch of the hammer, instead the trigger being forced to the reset position where its sear catches the sear catch of the hammer; and

wherein as the bolt carrier reciprocates to the rear and the forward arm of the ejector is lifted, the locking member is spring biased toward the first position, and as the bolt carrier returns forward, the forward arm of the ejector is depressed, which in turn moves the locking member to the second position in which it does not block the trigger member from being functioned by an external force away from the set position and when the bolt carrier reaches the substantially in-battery position, the user can pull the trigger member again to fire a subsequent round.

2. The firearm trigger mechanism of claim **1**, further comprising a trigger housing that supports the hammer, trigger member, ejector, and locking member, the trigger housing being insertable in a pocket of a trigger grip housing of the firearm.

3. The firearm trigger mechanism of claim 1, wherein the hammer includes a rearward projection carrying the sear catch and disconnector-engaging catch.

4. The firearm trigger mechanism of claim 1, wherein the safety selector blocks movement of the trigger member from the set position in the safe position, allows movement of the trigger member from the set position in the standard semi-automatic position, and both allows movement of the trigger member from the set position and prevents the disconnector hook from catching the disconnector-engaging catch of the hammer in the forced reset semi-automatic position.

5. The firearm trigger mechanism of claim 1, wherein the locking member is moved against the spring bias to the second position by contact from the forward arm of the ejector lever.

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